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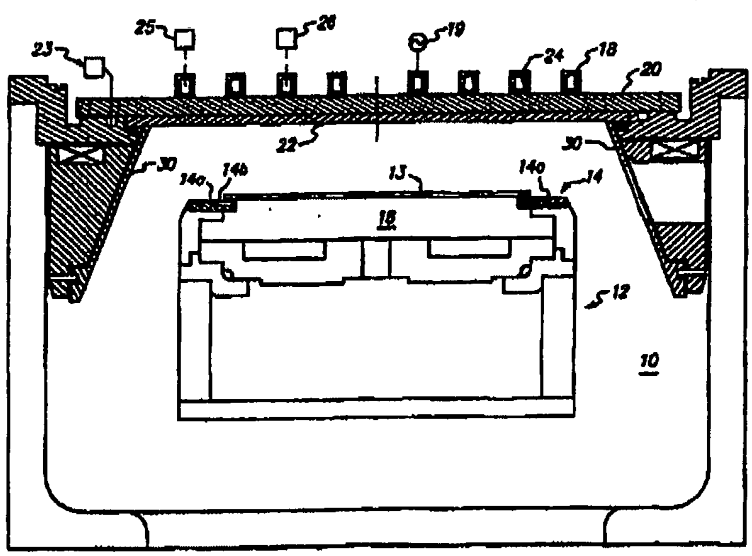

(57) Abstract

A plasma processing chamber includes a substrate holder and a member of silicon carbide such as a liner, focus ring, perforated baffle or a gas distribution plate, the member having an exposed surface adjacent the substrate holder and the exposed surface being effective to minimize contamination during processing of substrates. The chamber can include an antenna which inductively couples RF energy through the gas distribution plate to energize process gas into a plasma state.

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conductive material can be used to reduce arcing due to charge build-up on such insulation surfaces.

Plasma processing systems wherein an antenna coupled to a radiofrequency (RF) source energizes gas into a plasma state within a process chamber are disclosed in U.S. Patent Nos. 4,948,458; 5,198,718; 5,241,245; 5,304,279; and 5,401,350. In such systems, the antenna is located outside the process chamber and the RF energy is supplied into the chamber through a dielectric window. Such processing systems can be used for a variety of semiconductor processing applications such as etching, deposition, resist stripping, etc.

Summary of the Invention

An object of the present invention is to reduce metal and/or particle contamination of plasma processed substrates when substrates are processed continuously by using silicon carbide as the material of one or more reactor surfaces such as a chamber liner surrounding the substrate holder, a focus ring surrounding the substrate, a baffle plate between the liner and substrate holder, and/or a gas distribution plate facing the substrate.

According to one aspect of the invention, a method of processing a substrate and reducing contamination thereof comprises placing a substrate on a substrate holder in a processing chamber wherein a member such as a liner, gas distribution plate, baffle plate and/or focus ring forms an exposed surface in the processing chamber in an area adjacent the substrate holder, the member comprising a silicon carbide based material and the member being effective to minimize particle and/or metal contamination of the substrates during the processing step as a result of reduced plasma potential on the silicon carbide member and/or reduced sputtering of non-silicon carbide chamber interior surfaces. The method includes processing the substrate by supplying process gas to the processing chamber and energizing the process gas into a plasma state such

CONTAMINATION CONTROLLING METHOD AND PLASMA PROCESSING CHAMBER

Field of the Invention

The invention relates to improvements in a plasma processing chamber and to a method of processing a substrate in the plasma processing chamber such as by plasma etching an oxide layer on a semiconductor wafer.

Background of the Invention

Vacuum processing chambers are generally used for chemical vapor depositing (CVD) and etching of materials on substrates by supplying process gas to the vacuum chamber and application of an RF field to the gas. Examples of parallel plate, transformer coupled plasma (TCP™, also called ICP), and electron-cyclotron resonance (ECR) reactors are disclosed in commonly owned U.S. Patent Nos. 4,340,462; 4,948,458; and 5,200,232. The substrates are held in place within the vacuum chamber during processing by substrate holders.

Conventional substrate holders include mechanical clamps and electrostatic clamps (ESC). Examples of mechanical clamps and ESC substrate holders are provided in commonly owned U.S. Patent No. 5,262,029 and commonly owned U.S. Application No. 08/401,524 filed on March 10, 1995. Substrate holders in the form of an electrode can supply radiofrequency (RF) power into the chamber, as disclosed in U.S. Patent No. 4,579,618. According to U.S. Patent No. 5,292,399, metal surfaces of wafer support and clamping ring mechanisms can be covered with insulating material to prevent erosion by the plasma and electrically

Brief Description of the Drawings

The invention will be described in greater detail with reference to the accompanying drawings in which like elements bear like reference numerals, and wherein:

FIG. 1 is a cross sectional view of a vacuum processing chamber having a liner, focus ring, baffle and/or gas distribution plate according to the invention;

FIG. 2 is a cross sectional view of a modified vacuum processing chamber according to the invention wherein the liner is cylindrical in shape;

FIG. 3 is a cross sectional view of a portion of a modified vacuum processing chamber in accordance with the invention wherein the liner includes a cylindrical portion and a conical portion; and

FIG. 4 is a top view of a baffle ring according to the invention.

Detailed Description of the Preferred Embodiments

In plasma gas processing of semiconductor substrates such as silicon wafers, high density plasmas typically cause a relatively high erosion rate of chamber interior surfaces they contact due to physical and/or chemical sputtering. This is an important issue in applications for wafer processing in the semiconductor industry, due to the sensitivity of devices on the wafer to contamination from metals which are deep impurities in silicon such as nickel and iron, alkali metals such as sodium and potassium that are mobile ions in the gate oxide of devices causing unstable threshold voltage, and metals such as aluminum which cause leakage currents in device junctions resulting, for example, in short refresh times in DRAM memory cells. Because of this, the surfaces of the chamber exposed to the high density plasma in such wafer processing tools are normally covered with a nonmetallic material such as alumina or quartz.

as by inductively coupling RF energy through the gas distribution plate into the processing chamber and consecutively processing substrates in the processing chamber by contacting the substrates with the plasma gas. The processing chamber can include a substantially planar antenna and the process gas can be energized into the plasma state by supplying RF power to the antenna. The plasma can comprise a high density plasma and the substrates can be processed by etching an oxide layer on the substrates with the high density plasma while supplying an RF bias to the substrates. The member preferably consists essentially of hot pressed, sintered, CVD or reaction bonded SiC.

According to another aspect of the invention, a plasma processing chamber includes a member comprising a silicon carbide based material, the member comprising a chamber liner, a focus ring, a baffle plate and/or a gas distribution plate. The chamber further includes a substrate holder for supporting a substrate within the processing chamber, a gas supply supplying process gas to an interior of the chamber, and an energy source such as an RF energy source which supplies RF energy into the chamber to energize the process gas into a plasma state. The chamber can further include a dielectric window adjacent the gas distribution plate and the RF energy source can comprise a substantially planar antenna adjacent the window, the antenna supplying RF power through the window to energize process gas in the processing chamber into a plasma state. The antenna can be arranged such that the gas outlets in the gas distribution plate are not directly between the substrate holder and the antenna. The dielectric window can have a substantially uniform thickness and substantially planar configuration and the gas distribution plate can have a substantially uniform thickness and substantially planar configuration.

consist entirely of SiC, comprise a SiC coated material such as SiC coated graphite, or principally SiC with 10 to 20% Si added to fill porosity in reaction bonded SiC.

In plasma etching, features can be etched into layers of various materials on substrates such as silicon wafers. In such etching processes, a gas distribution plate can be used to control the spatial distribution of gas flow in the volume of the reactor above the plane of the wafer. In the TCP 9100™ plasma etching reactor available from LAM Research Corporation, the gas distribution plate is a circular plate situated directly below the TCP™ window which is also the vacuum sealing surface at the top of the reactor in a plane above and parallel to the wafer. The gas distribution plate is sealed using an O-ring to a gas distribution ring located at the periphery of the gas distribution plate. The gas distribution ring feeds gas from a source into the volume defined by the gas distribution plate, an inside surface of a window underlying a coil supplying RF energy into the reactor, and the gas distribution ring. The gas distribution plate contains an array of holes of a specified diameter which extend through the plate. The spatial distribution of the holes through the gas distribution plate can be varied to optimize etch uniformity of the layers to be etched, e.g., a photoresist layer, a silicon dioxide layer and an underlayer material on the wafer. The cross-sectional shape of the gas distribution plate can be varied to manipulate the distribution of RF power into the plasma in the reactor. The gas distribution plate material must be a dielectric to enable coupling of this RF power through the gas distribution plate into the reactor. Further, the material of the gas distribution plate must be highly resistant to chemical sputter-etching in environments such as oxygen or a hydrofluorocarbon gas plasma in order to avoid breakdown and the resultant particle generation associated therewith. Moreover, the material of the gas distribution plate should have low levels of contaminants that might otherwise affect performance of devices on the wafer. According to the invention, the gas

Alumina and quartz are dielectric materials which present a high impedance to the RF current used to sustain the plasma, and the RF current used to induce a bias voltage on the wafer. As a result, the RF current through the plasma does not have a good ground path and can become unstable, resulting in non-repeatable etch results. Moreover, charge build-up on the dielectric materials can cause arcing and thus localized sputtering of the dielectric materials.

The present invention uses silicon carbide (SiC) as a consumable chamber surface material which reduces metal and/or particle contamination of the processed substrates. The SiC is preferably electrically conductive so that when it is in contact with the plasma it presents a good ground path for the RF current. The SiC also etches at a slow rate by the plasma making it a cost effective consumable part. Moreover, because the SiC is of high purity, wafer contamination resulting from chemical sputtering of the SiC by the plasma can be minimized. Further, the grounded SiC can reduce sputtering of other surfaces in the chamber by causing a reduction in the plasma potential and hence ion bombardment energy to these non-silicon carbide surfaces. To the extent the SiC component replaces alumina as a chamber surface, aluminum contamination of wafers can be reduced. Finally, the SiC component provides a very stable plasma potential so that etch results are more repeatable within an individual chamber and from chamber to chamber.

The invention provides improvements in reducing contamination of substrates such as semiconductor wafers, flat panel display substrates, and the like. The reduced contamination can be achieved by utilizing silicon carbide as the material for members adjacent the substrate being processed in the chamber. Such members include non-electrically driven chamber parts such as liners, focus rings, gas distribution plates, baffle plates and the like. As an example, an SiC liner can be used to provide a better RF return path for the powered electrode (bottom electrode) in the wafer support. The SiC liner provides a grounded surface which is resistant to erosion from ion bombardment. The insert can

distribution plate can be of specially prepared silicon carbide having high resistivity.

According to another aspect of the invention, it has surprisingly and unexpectedly been found that use of silicon carbide for interior chamber surfaces provides performance results which far exceed other materials such as aluminum nitride and alumina. Preferably, the silicon carbide material is electrically grounded thereby reducing plasma potential on surfaces within the chamber.

A vacuum processing chamber according to one embodiment of the present invention is illustrated in FIG. 1. The vacuum processing chamber 10 includes a substrate holder 12 providing an electrostatic clamping force to a substrate 13 as well as an RF bias to a substrate while it is He backcooled. A focus ring 14 comprising a dielectric outer ring 14a and a SiC inner ring 14b confines plasma in an area above the substrate. A source of energy for maintaining a high density (e.g., 10^{11}-10^{12} ions/cm^3) plasma in the chamber such as an antenna 18 powered by a suitable RF source and suitable RF impedance matching circuitry inductively coupled RF energy into the chamber 10 so as to provide a high density plasma. The chamber includes suitable vacuum pumping apparatus for maintaining the interior of the chamber at a desired pressure (e.g., below 50 mTorr, typically 1-20 mTorr). A substantially planar dielectric window 20 of uniform thickness provided between the antenna 18 and the interior of the processing chamber 10 forms the vacuum wall at the top of the processing chamber 10. A gas distribution plate 22 is provided beneath window 20 and includes openings such as circular holes for delivering process gas from the gas supply 23 to the chamber 10. A conical liner 30 extends from the gas distribution plate and surrounds the substrate holder 12. The antenna 18 can be provided with a channel 24 through which a temperature control fluid is passed via inlet and outlet conduit 25,26. However, the antenna 18 and/or window 20 could be cooled by other techniques such as by blowing air over the antenna and window, passing a cooling medium

through or in heat transfer contact with the window and/or gas distribution plate, etc.

In operation, a wafer is positioned on the substrate holder 12 and is typically held in place by an electrostatic clamp, a mechanical clamp, or other clamping mechanism when He backcooling is employed. Process gas is then supplied to the vacuum processing chamber 10 by passing the process gas through a gap between the window 20 and the gas distribution plate 22. Suitable gas distribution plate arrangements (i.e., showerhead) arrangements are disclosed in commonly owned U.S. Patent Application Serial Nos. 08/509,080; 08/658,258; and 08/658,259, the disclosures of which are hereby incorporated by reference. For instance, while the window and gas distribution plate arrangement in FIG. 1 are planar and of uniform thickness, non-planar and/or non-uniform thickness geometries can be used for the window and/or gas distribution plate. A high density plasma is ignited in the space between the substrate and the window by supplying suitable RF power to the antenna 18. A temperature control fluid can also be passed through the channel 24 in the antenna 18 to maintain the antenna 18, window 20 and gas distribution plate 22 at a temperature below a threshold temperature such as less than 120°C, preferably below 90°C and more preferably below 80°C.

A vacuum processing chamber according to another embodiment of the present invention is illustrated in FIG. 2. The vacuum processing chamber 40 includes a substrate holder 42 providing an electrostatic clamping force to a substrate 43 as well as an RF bias to a substrate supported thereon. A focus ring 44 having outer dielectric portion 44a and inner SiC portion 44b confines plasma in an area above the substrate while it is He backcooled. A source of energy for maintaining a high density (e.g. 10^{11}-10^{12} ions/cm^3) plasma in the chamber such as an antenna (not shown) powered by a suitable RF source and suitable RF impedance matching circuitry inductively couples RF energy into the chamber 40 so as to provide a high density plasma. The chamber includes suitable vacuum

pumping apparatus for maintaining the interior of the chamber at a desired pressure (e.g. below 50 mTorr, typically 1-20 mTorr). A substantially planar dielectric window of uniform thickness can be provided between the antenna and the interior of the processing chamber 40 and to form the vacuum wall at the top of the processing chamber 40. A gas distribution plate, commonly called a showerhead 50, is provided beneath the window and includes a plurality of openings such as circular holes (not shown) for delivering process gas supplied by a suitable gas supply to the processing chamber 40. A cylindrical liner 60 extends from the gas distribution plate and surrounds the substrate holder 42. A baffle ring 70 extends between the substrate holder 42 and the liner 60. The liner 60 and/or the baffle ring 70 can be heated by a heating member 61 which can be heated by any suitable technique such as resistance heating, a heated fluid, etc. Details of the baffle ring 70 are shown in Fig. 4 wherein it can be seen that the baffle ring 70 includes small holes 72 and large holes 74 for passage of gases and by-products to a vacuum pump connected to the bottom of the chamber.

In another embodiment, as shown in Fig. 3, a modified liner 62 can include a cylindrical portion 64 and a conical portion 66. In this embodiment, a heater 68 includes resistive elements (not shown) which are used to maintain the portion 64 and/or portion 66 at a desired temperature.

Substrates which are etched in an oxide etching process generally include an underlayer, an oxide layer which is to be etched, and a photoresist layer formed on top of the oxide layer. The oxide layer may be one of SiO_2, BPSG, PSG, or other oxide material. The underlayer may be Si, TiN, silicide, or other underlying layer or substrate material. The etch selectivity, which is the etch rate of the layer to be etched compared to the photoresist etch rate is preferably around 4:1 or higher. The etch selectivity of the oxide layer compared to the underlayer is preferably greater than the oxide:photoresist etch selectively, e.g., 40:1.

According to the invention, a silicon carbide chamber liner, focus ring, baffle ring and/or gas distribution plate reduces metal and/or particle

contamination of substrates during processing such as etching of dielectric materials such as silicon dioxide (e.g., doped or undoped TEOS, BPSG, USG (undoped spin-on-glass), thermal oxide, plasma oxide, etc.) typically overlying a conductive layer such as silicon, polysilicon, silicide, titanium nitride, aluminum or a non-conductive material such as silicon nitride. According to the invention, features (such as contact holes, vias, trenches, etc.) can be provided having dimensions of 0.5 μm and below and aspect ratios ranging from 2:1 to 7:1 can be etched from substrate to substrate during sequential batch processing of substrates such as semiconductor wafers (e.g., 25 or more consecutive wafers) while maintaining particle contamination of the wafers below acceptable levels.

During oxide etching, the chamber pressure is typically below 300 mTorr, preferably 1-40 mTorr, the antenna is powered at 200-5000 watts, preferably 300-2500 watts, the RF bias is ≤6000 watts, preferably 1000-2500 watts, and the He backpressure is 5-40 Torr, preferably 7-20 Torr. The process gas can include 10-200 sccm CHF_3, 10-100 sccm C_2HF_5 and/or 10-100 sccm C_2F_6.

The silicon carbide member is preferably formed as a separate piece attachable to the reaction chamber by any suitable technique. For instance, a silicon carbide liner can be bolted to an electrically grounded part of the chamber thereby providing grounding of the liner. Alternatively, the silicon carbide can be a coating on metal and/or ceramic parts of the chamber. In the case where the silicon carbide member is a gas distribution plate, the silicon carbide preferably has a resistivity high enough to allow an RF antenna to couple RF energy into the chamber. For instance, the silicon carbide can be hot pressed to obtain resistivity values on the order of about 5×10^4 Ω·cm. For even higher resistivities, SiC powder can be doped with a suitable additive or sintered in a nitrogen atmosphere to form Si_3N_4 in grain boundaries of the silicon carbide and thus raise the resistivity to values such as 1×10^8 Ω·cm. In making a gas distribution plate, suitable gas passages and outlet holes can be provided in a green ceramic material which is later sintered to form a unitary plate. In order to prevent plasma from

striking in the passages and/or holes, the dimensions of the passages and holes are preferably small enough to avoid conditions under which plasma would form during flow of process gas and powering of the antenna.

The liner, focus ring, baffle plate and/or gas distribution plate can be made of various blends of silicon carbide based powder material having a predominant amount of silicon carbide. For instance, the total amount of silicon and carbon is typically at least 90 wt %, preferably ≥ 95 wt %, and more preferably ≥99 wt %. For example, the SiC member may include up to about 0.5% B to aid sintering of the SiC powder. The SiC member may include an excess of Si such as up to about 35 wt% free Si and/or Si_3N_4. The silicon carbide material can be made by any suitable process such as hot pressing, sintering, reaction bonding (e.g., wherein SiC is infiltrated with molten Si), etc. For uses such as the liner, focus ring and/or baffle, the silicon carbide preferably has a low resistivity such as below 200 Ω·cm. The resistivity is much higher, however, when the SiC member is used for a window and/or gas distribution plate used in conjunction with an RF antenna. If a different RF source is used, the window/gas distribution plate can be replaced with a low resistivity SiC member. In order to avoid metal contamination during processing of semiconductor substrates, the SiC member is preferably made by a process which avoids the presence of such metals in the SiC member. The silicon and carbon are preferably present in amounts sufficient achieve a nominal SiC stoichiometry. Such mixtures can be formed into a desired shape, sintered and machined to desired tolerances and/or surface finishes on surfaces such as vacuum sealing surfaces. The SiC member preferably is highly dense, e.g., having a density over 3.1 g/cm^3.

In the case where the SiC member is formed by CVD, it is preferable to deposit enough SiC to form a bulk member. For instance, SiC can be deposited on a graphite mandrel and when a desired thickness of SiC is achieved, the graphite mandrel can be etched away leaving a highly pure and highly dense SiC member.

The silicon carbide member according to the invention provides dramatic reduction in particle count on wafers processed during oxide etching and oxygen cleaning steps. The silicon carbide member also reduces particle contamination during an ashing process wherein 750 sccm oxygen gas can be run for 10 seconds with the TCP™ power at 650 W, the bottom electrode at 750 W and the pressure at 10 mTorr. Compared to an alumina liner which is attacked during the etching and oxygen cleaning steps and can liberate aluminum which could contaminate wafers, a silicon carbide liner provides better contamination performance since there is preferably less than 200 ppm Al in the silicon carbide material. Moreover, during processing such as plasma etching, by-products produced as a result of erosion of the SiC are volatile and thus do not contribute to adding particles on the wafers and the liberated elements Si and C are not detrimental to wafer processing.

The foregoing has described the principles, preferred embodiments and modes of operation of the present invention. However, the invention should not be construed as being limited to the particular embodiments discussed. Thus, the above-described embodiments should be regarded as illustrative rather than restrictive, and it should be appreciated that variations may be made in those embodiments by workers skilled in the art without departing from the scope of the present invention as defined by the following claims.

Claims:

1. A method of processing a substrate and reducing metal and/or particle contamination thereof comprising steps of:

(a) placing a substrate on a substrate holder in a processing chamber, the processing chamber including at lease one member having an exposed surface adjacent the substrate, the member comprising a silicon carbide based material;

(b) processing the substrate by supplying process gas to the processing chamber and energizing the process gas into a plasma state in the processing chamber, the silicon carbide member being in contact with the plasma and providing a ground path for RF current sustaining the plasma;

(c) removing the substrate from the processing chamber; and

(d) consecutively processing additional substrates in the processing chamber by repeating steps (a-c) while minimizing particle contamination of the substrates during the processing step as a result of reduction of plasma potential on the silicon carbide member and/or reduced sputtering of non-silicon carbide chamber interior surfaces.

2. The method according to Claim 1, wherein the silicon carbide member comprises a liner forming a sidewall of the processing chamber, the processing chamber including a substantially planar antenna which energizes the process gas into the plasma state by supplying RF power to the antenna and the process gas comprising one or more hydrofluorocarbon gases.

3. The method according to Claim 1, wherein the plasma comprises a high density plasma and the substrates are processed by etching an oxide layer on the substrates with the high density plasma while supplying an RF bias to the substrates.

4. The method according to Claim 1, wherein the silicon carbide member comprises a liner forming a sidewall of the processing chamber, a gas distribution plate supplying the process gas to the processing chamber, a perforated baffle extending between the substrate bolder and an inner wall of the processing chamber, and/or a focus ring surrounding the substrate.

5. The method according to Claim 1, wherein the silicon carbide member comprises a liner forming a sidewall of the processing chamber, the liner being surrounded by a heated member which maintains the liner at a desired temperature.

6. The method according to Claim 1, wherein the silicon carbide member consists essentially of hot-pressed, sintered, CVD or reaction bonded SiC or a composite wherein a coating of SiC forms the exposed surface of the silicon carbide member.

7. The method according to Claim 1, wherein the silicon carbide member comprises a heated liner and a baffle, the liner surrounding the substrate holder and the baffle comprising a foraminous ring extending between the liner and the substrate holder, the liner being heated to a temperature above room temperature during the processing step.

8. The method according to Claim 1, wherein the silicon carbide member comprises a gas distribution plate having a resistivity high enough to make the silicon carbide member an insulating material, the process gas being energized by an antenna which couples RF energy into the chamber through the gas distribution plate.

9. The method according to Claim 8, wherein the silicon carbide member further includes a liner having a resistivity below 200 Ω·cm.

10. A plasma processing chamber comprising:

a substrate holder for supporting a substrate within an interior of the processing chamber;

at least one member having an exposed surface adjacent the substrate, the member comprising a silicon carbide based material;

a gas supply supplying process gas to the interior of the processing chamber; and

an energy source supplying energy into the interior of the processing chamber and energizing the process gas into a plasma state for processing a substrate, the silicon carbide member minimizing particle contamination of substrates during plasma processing thereof as a result of reduction of plasma potential on the silicon carbide member and/or reduced sputtering of non-silicon carbide chamber interior surfaces.

11. The plasma processing chamber according to Claim 10, wherein the silicon carbide member comprises a liner forming a sidewall of the processing chamber, the liner being surrounded by a heated member which maintains the liner at a desired temperature.

12. The plasma processing chamber according to Claim 10, wherein the processing chamber includes a dielectric window and the energy source comprises an RF energy source in the form of a substantially planar antenna adjacent the window, the antenna supplying RF power through the window to energize process gas in the processing chamber into a plasma state.

13. The plasma processing chamber according to Claim 10, wherein the silicon carbide member comprises a gas distribution plate, a focus ring, a perforated baffle between the substrate holder and an inner wall of the processing chamber, and/or a chamber liner.

14. The plasma processing chamber according to Claim 10, wherein the silicon carbide member comprises a cylindrical and/or conical liner forming a sidewall of the processing chamber.

15. The plasma processing chamber according to Claim 10, wherein the at least one silicon carbide member comprises a SiC liner and a SiC baffle ring.

16. The plasma processing chamber according to Claim 11, wherein the at least one silicon carbide member further comprises a SiC baffle ring in contact with the liner and/or the heated member.

17. The plasma processing chamber according to Claim 10, wherein the silicon carbide member has a resistivity of at least about 5×10^4 Ω·cm.

18. The plasma processing chamber according to Claim 10, wherein the silicon carbide member consists essentially of hot-pressed, sintered, CVD or reaction bonded SiC or a composite wherein a coating of SiC forms the exposed surface of the silicon carbide member.

19. The plasma processing chamber according to Claim 10, wherein the at least one silicon carbide member comprises a SiC liner and a SiC gas distribution plate, the gas distribution plate having a resistivity high enough to make the gas distribution plate an insulating material and the liner having a resistivity low enough to make the liner electrically conducting.

20. The plasma processing chamber according to Claim 10, wherein the silicon carbide member has a density of at least 3.1 g/cm^3 and includes at least 99 wt% carbon and silicon.

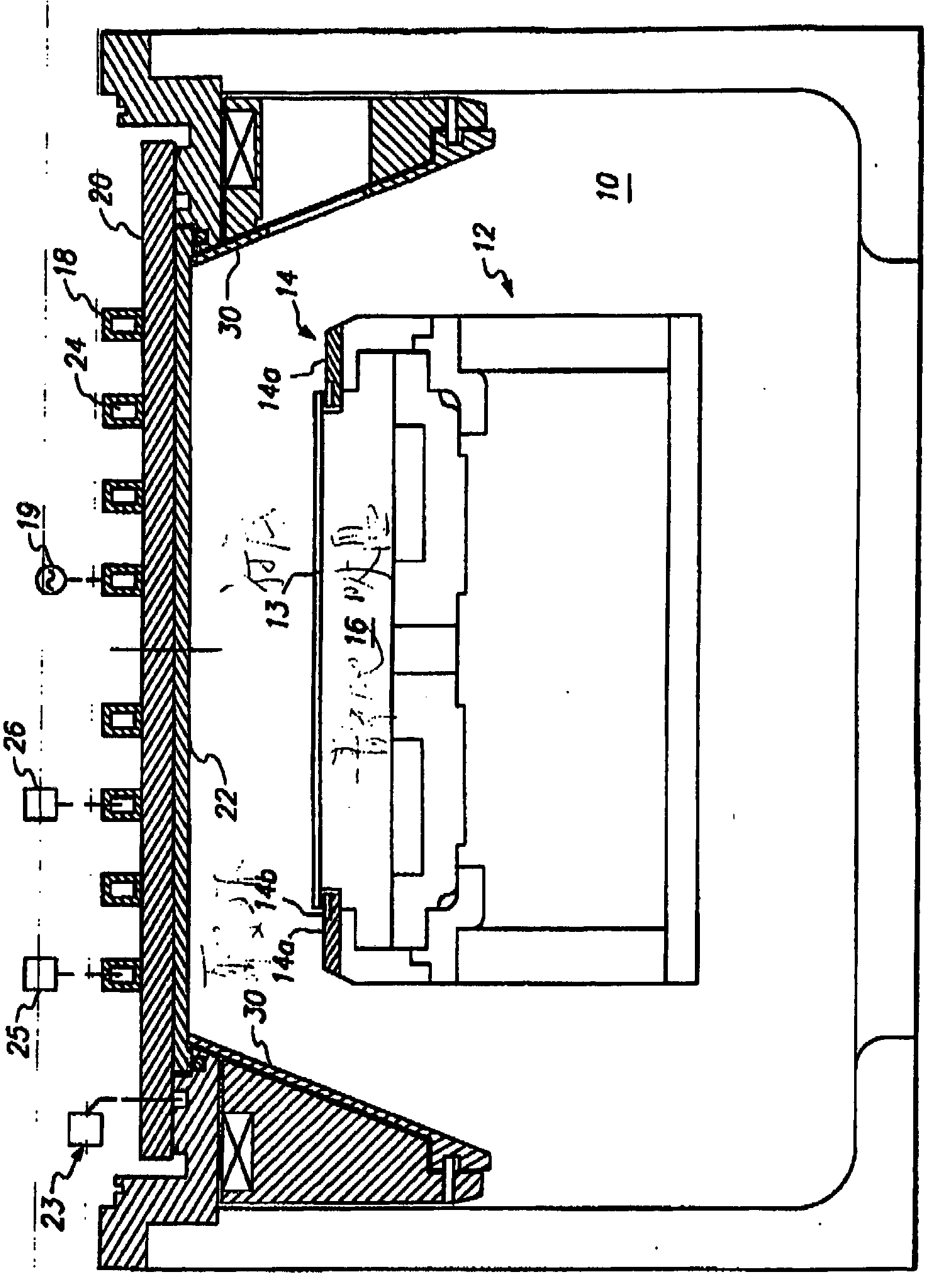

FIG. 1

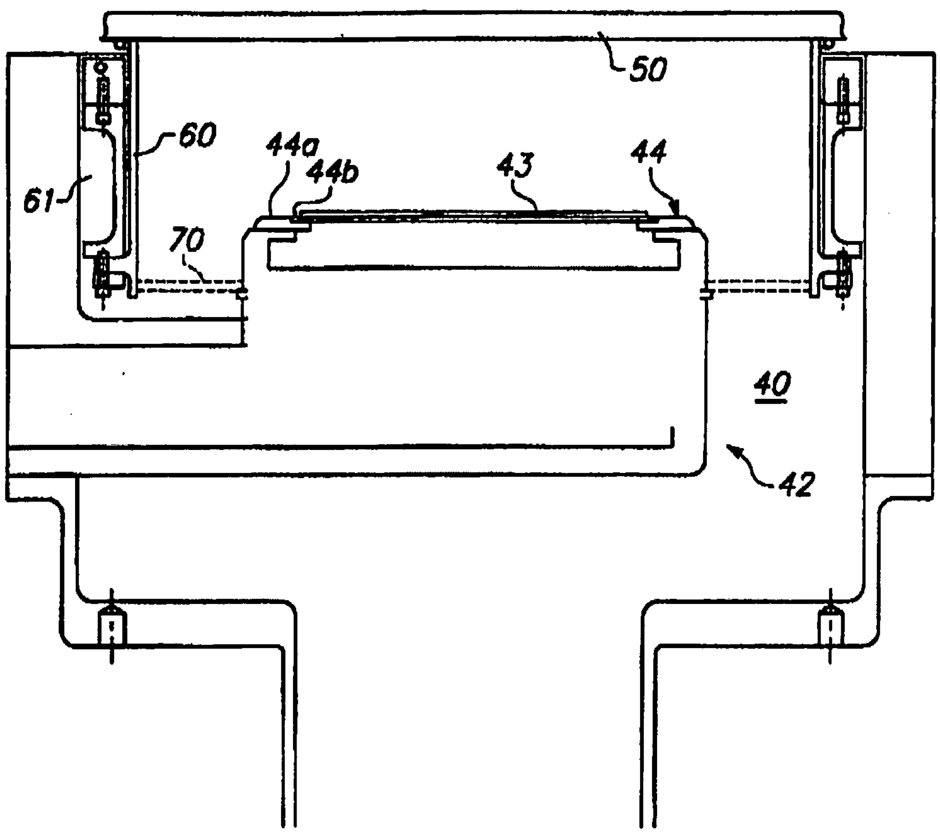

FIG. 2

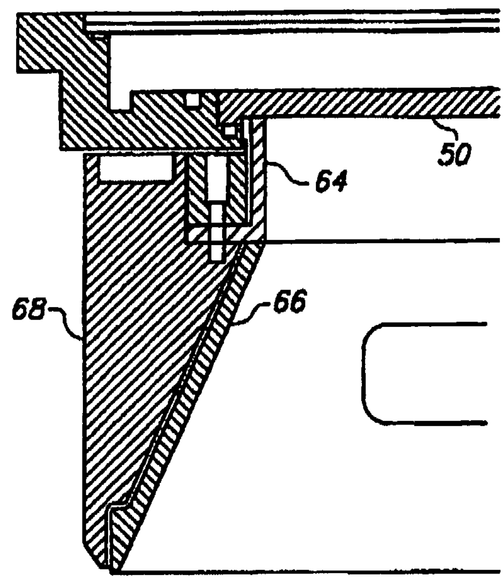

FIG. 3

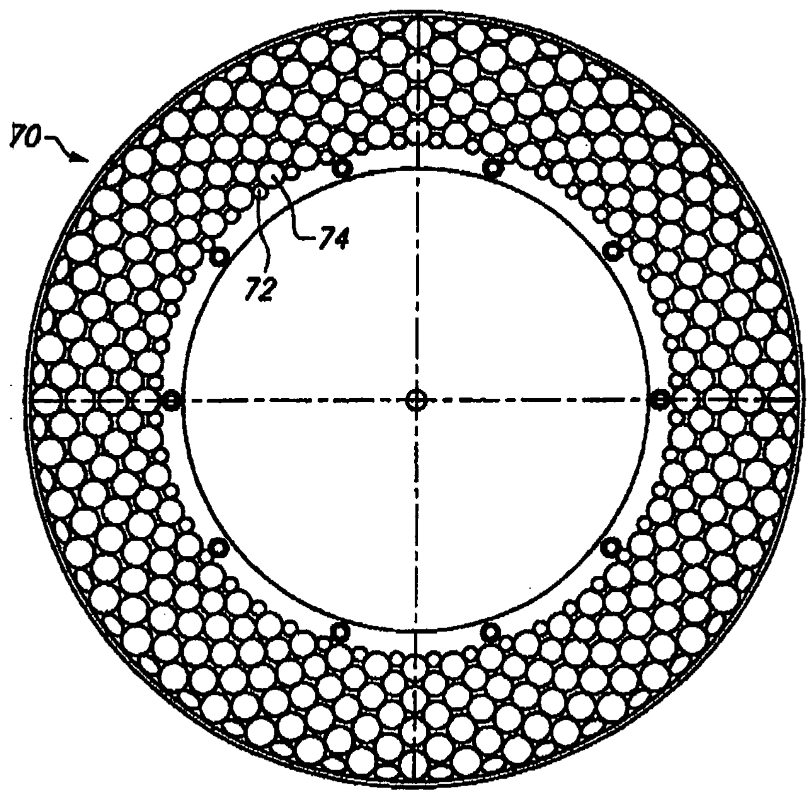

FIG. 4

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/06658

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 H01J37/32

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 H01J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 821 397 A (APPLIED MATERIALS INC) 28 January 1998 see abstract see page 9, line 26-39 see page 1, line 1-31; claim 18; figures 1,8-10 ---	1-3,5,6, 10,11, 14,17,18
X	US 5 006 220 A (HIJIKATA ISAMU ET AL) 9 April 1991 see abstract see column 1, line 55 - column 3, line 47; figures 1-3 ---	1,4,8, 10,18,19
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[X] Further documents are listed in the continuation of box C.

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
7 July 1999	28/07/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Centmayer, F

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INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 99/06658

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 779 651 A (HITACHI LTD) 18 June 1997 see abstract see column 3, line 19-27; claims 4,8,12; figures 1,3,4,6 see column 8, line 22-24	1,3,5,7, 10-13
X	EP 0 826 646 A (ASAHI GLASS CO LTD) 4 March 1998 see page 2, line 21-56	1,2,10
A	US 5 304 279 A (KELLER JOHN H ET AL) 19 April 1994 cited in the application	
A	US 5 198 718 A (BAYLISS KEITH H ET AL) 30 March 1993 cited in the application	

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 99/06658

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
EP 0821397	A	28-01-1998	US	5904778	A	18-05-1999
			JP	10139547	A	26-05-1998
US 5006220	A	09-04-1991	US	5022979	A	11-06-1991
EP 0779651	A	18-06-1997	JP	9102484	A	15-04-1997
			JP	9293725	A	11-11-1997
EP 0826646	A	04-03-1998	JP	10120466	A	12-05-1998
US 5304279	A	19-04-1994	NONE			
US 5198718	A	30-03-1993	DE	69019741	D	29-06-1995
			DE	69019741	T	28-09-1995
			EP	0462165	A	27-12-1991
			WO	9010945	A	20-09-1990
			JP	2648235	B	27-08-1997
			JP	4504025	T	16-07-1992

中华人民共和国国家知识产权局

100032 北京市金融街35号国际企业大厦A座16层 北京三友知识产权代理有限公司 王一斌	发文日 专利局 2007.3.9 发文
申请号：2004100903758	

申请人：台湾积体电路制造股份有限公司

发明名称：晶片基座

第 2 次审查意见通知书

1. ☑审查员已收到申请人于2006年12月12日提交的意见陈述书，在此基础上审查员对上述专利申请继续进行实质审查。

☐根据国家知识产权局专利复审委员会于　　年　月　日作出的复审决定，审查员对上述专利申请继续实质审查。

☐

2. ☐申请人于　　年　月　日提交的修改文件，不符合专利法实施细则第51条第3款的规定。
3. 继续审查是针对下述申请文件进行的：

☐上述意见陈述书中所附的经修改的申请文件。

☑前次审查意见通知书所针对的申请文件以及上述意见陈述书中所附的经修改的申请文件替换页。

☐前次审查意见通知书所针对的申请文件。

☐上述复审决定所确定的申请文件。

☐

4. ☐本通知书未引用新的对比文件。

☑本通知书引用下述对比文件(其编号续前，并在今后的审查过程中继续沿用)：

编号	文件号或名称	公开日期（或抵触申请的申请日）
2	WO 99/50886 A1	1999-10-7

5. 审查的结论性意见：

☐关于说明书：

☐申请的内容属于专利法第5条规定的不授予专利权的范围。

☐说明书不符合专利法第26条第3款的规定。

☐说明书的修改不符合专利法第33条的规定。

☐说明书的撰写不符合专利法实施细则第18条的规定。

☐

☑关于权利要求书：

☐权利要求＿＿＿不具备专利法第22条第2款规定的新颖性。

☑权利要求 1－21 不具备专利法第22条第3款规定的创造性。

☐权利要求＿＿＿不具备专利法第22条第4款规定的实用性。

☐权利要求＿＿＿属于专利法第25条规定的不授予专利权的范围。

☐权利要求＿＿＿不符合专利法第26条第4款的规定。

☐权利要求＿＿＿不符合专利法第31条第1款的规定。

☐权利要求＿＿＿的修改不符合专利法第33条的规定。

☐权利要求＿＿＿不符合专利法实施细则第2条第1款的规定。

☐权利要求＿＿＿不符合专利法实施细则第13条第1款的规定。

中华人民共和国国家知识产权局 专利审查业务章 105

申请号 2004100903758

☐权利要求________不符合专利法实施细则第 20 条的规定。
☐权利要求________不符合专利法实施细则第 21 条的规定。
☐权利要求________不符合专利法实施细则第 22 条的规定。
☐权利要求________不符合专利法实施细则第 23 条的规定。
☐________
☐分案的申请不符合专利法实施细则第 43 条第 1 款的规定。

上述结论性意见的具体分析见本通知书的正文部分。

6. 基于上述结论性意见，审查员认为：

☐申请人应按照通知书正文部分提出的要求，对申请文件进行修改。
☐申请人应在意见陈述书中论述其专利申请可以被授予专利权的理由，并对通知书正文部分中指出的不符合规定之处进行修改，否则将不能授予专利权。
☑专利申请中没有可以被授予专利权的实质性内容，如果申请人没有陈述理由或者陈述理由不充分，其申请将被驳回。
☐________

7. 申请人应注意下述事项：

(1) 根据专利法第 37 条的规定，申请人应在收到本通知书之日起的贰个月内陈述意见，如果申请人无正当理由逾期不答复，其申请将被视为撤回。
(2) 申请人对其申请的修改应符合专利法第 33 条和实施细则第 51 条的规定，修改文本应一式两份，其格式应符合审查指南的有关规定。
(3) 申请人的意见陈述书和/或修改文本应邮寄或递交国家知识产权局专利局受理处，凡未邮寄或递交给受理处的文件不具备法律效力。
(4) 未经预约，申请人和/或代理人不得前来国家知识产权局专利局与审查员举行会晤。

8. 本通知书正文部分共有 2 页，并附有下述附件：

☑引用的对比文件的复印件共 1 份 25 页。
☐________

审查员：吴晓达(9531)　　　　审查部门　审查协作中心

2007 年 2 月 9 日

第二次审查意见通知书正文

申请号：2004100903758

该申请（200410090375.8）涉及一种晶片基座，审查员于2006年10月13日发出了第一次审查意见通知书，申请人于2006年12月12日针对第一次审查意见通知书提交了意见陈述书和权利要求书的替换页，审查员在此基础上继续审查，意见如下：

关于权利要求书：

权利要求1请求保护一种晶片基座，对比文件2（WO9950886 A1）公开的技术方案公开了一种等离子体处理室中衬底支撑装置（参见对比文件第7－8页及附图1），包括用于吸附衬底13的静电吸盘16镶嵌于底座中、该静电吸盘顶部宽度小于底部宽度，静电吸盘的上部设有聚焦环14，其中在放置衬底的情况下，静电吸盘16被完全覆盖，虽然对比文件2公开的技术方案中并未明确限定包围静电吸盘16的部件为绝缘材料，但是这是必须的，可见权利要求1与对比文件2公开的技术方案相比，二者的区别仅仅在于对比文件2公开的技术方案中聚焦环不是陶瓷材料的，对比文件1（JP8-181107 A）公开了一种等离子反应室中晶片的支撑结构，恰好披露了如下技术内容（参见说明书第2－4栏及附图1）：电极11上部宽度小于下部，并放置有陶瓷圆环15，在陶瓷圆环上放置晶片13，对于本领域的技术人员来说，支撑晶片部件的材料选择是常用的技术，采用陶瓷或其他绝缘材料都是常用的，而权利要求1采用该陶瓷材料也并未取得预料不到的技术效果，所以相对于对比文件2和1相结合得到的技术方案权利要求1不具备突出的实质性特点和显著的进步，不符合专利法第22条第3款关于创造性的规定。

权利要求2－6的附加技术特征是关于导体层、陶瓷盖板的结构限定，对比文件1公开的技术方案公开了同样的内容（参见对权利要求1的评述），所以在权利要求2－6直接或间接引用的权利要求1不具备创造性的情况下，权利要求2－6同样不具备创造性，不符合专利法第22条第3款的规定。

权利要求7－9的附加技术特征是关于各部件的材料的限定，虽然对比文件并未限定同样的内容但是对于本领域的技术人员来说这些都是常用的材料，是容易想到的，而且权利要求7－9采用该材料也并未取得预料不到的技术效果，所以在权利要求7－9引用的权利要求1不具备创造性的情况下，权利要求7－9同样不具备创造性，不符合专利法第22条第3款的规定。

权利要求10请求保护一种晶体基座，与权利要求1相比，虽然二者的特征描述不完全相同，但是二者的保护范围实质上是相同的，所以相对于对比文件2和1相结合得到的技术方案，权利要求10同样不具备创造性，同样不符合专利法第22条第3款的规定。

权利要求11、12的附加技术特征是关于导体层的形状限定，对比文件1公开的技术方案公开了同样的内容（参见对权利要求10的评述），所以在权利要求11、12引用的权利要求10不具备创造性的情况下，权利要求11、12同样不具备创造性，不符合专利法第22条第3款的规定。

权利要求13、14的附加技术特征是关于陶瓷盖板的结构限定，对比文件1公开的技术方案公开了同样的内容（参见对权利要求10的评述），所以在权利要求13、14引用的权利要求12不具备创造性的情况下，权利要求13、14同样不具备创造性，不符合专利法第22条第3款的规定。

权利要求15的附加技术特征是关于陶瓷盖板的形状的限定，对比文件1公开的技术方案公开了同样的内容（参见对权利要求10的评述），所以在权利要求15引用的权利要求10不具备创造性的情况下，权利要求15同样不具备创造性，不符合专利法第22条

第3款的规定。

权利要求16－18的附加技术特征是关于各部件的材料的限定，虽然对比文件并未限定同样的内容但是对于本领域的技术人员来说这些都是常用的材料，是容易想到的，而且权利要求16－18采用该材料也并未取得预料不到的技术效果，所以在权利要求16－18引用的权利要求10不具备创造性的情况下，权利要求16－18同样不具备创造性，不符合专利法第22条第3款的规定。

权利要求19请求保护一种晶片基座，对比文件2（WO9950886 A1）公开的技术方案公开了一种等离子体处理室中衬底支撑装置（参见对比文件第7－8页及附图1），包括用于吸附衬底13的静电吸盘16镶嵌于底座中、聚焦环14，其中在放置衬底的情况下，静电吸盘16被完全覆盖，虽然对比文件2公开的技术方案中并未明确限定包围静电吸盘16的部件为绝缘材料，但是这是必须的，可见权利要求1与对比文件2公开的技术方案相比，二者的区别仅仅在于对比文件2公开的技术方案中聚焦环不是陶瓷材料的以及静电吸盘未限定是钛的，对比文件1（JP8-181107 A）公开了一种等离子反应室中晶片的支撑结构，恰好披露了如下技术内容（参见说明书第2－4栏及附图1）：电极11上部宽度小于下部，并放置有陶瓷圆环15，在陶瓷圆环上放置晶片13，对于本领域的技术人员来说，支撑晶片部件的材料选择是常用的技术，采用陶瓷或其他绝缘材料都是常用的，而采用钛作为电极材料也是常用的技术，而权利要求19采用该陶瓷材料以及钛金属也并未取得预料不到的技术效果，所以相对于对比文件2和1相结合得到的技术方案权利要求19不具备突出的实质性特点和显著的进步，不符合专利法第22条第3款关于创造性的规定。

权利要求20的附加技术特征是关于陶瓷盖板的结构限定，对比文件1公开的技术方案公开了同样的内容（参见对权利要求19的评述），所以在权利要求20引用的权利要求19不具备创造性的情况下，权利要求20同样不具备创造性，不符合专利法第22条第3款的规定。

权利要求21的附加技术特征是关于陶瓷材料的限定，虽然对比文件并未限定同样的内容但是对于本领域的技术人员来说这些都是常用的材料，是容易想到的，而且权利要求21采用该材料也并未取得预料不到的技术效果，所以在权利要求21引用的权利要求19不具备创造性的情况下，权利要求21同样不具备创造性，不符合专利法第22条第3款的规定。

基于上述情况，该申请不具备授权前景，而且说明书中也未记载其他可授予专利权的实质性内容，若申请人不能针对通知书的意见陈述具有说服力的理由，该申请将被驳回。

审查员：吴晓达

代码：9531

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